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Cash-Flow Risks, Financial Leverage and the Cross Section of Equity Returns

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Abstract
What is the cross-sectional relationship between financial leverage and expected equity returns? How is the empirical relationship associated with firm's financial decisions? This dissertation investigates the potential explanations for the flatness relation between financial leverage and expected equity returns, and its link to firms' capital structure determinants. Empirical evidence contradicts the theoretical prediction that leverage amplifies the equity risks. I decompose expected equity returns of book leverage portfolios according to their exposure to cash flow and discount rate risk. I find that low leverage firms have lower cash-flow beta and higher discount-rate beta than firms with high leverage. Although cash flow beta typically has a higher price of risk, book leverage portfolios load disproportionately on discount-rate beta, generating an essentially flat relation. Moreover, the main determinants of firms' capital structures are related to firms' sensitivities to these systematic sources of risk and have different importance for low and high leverage firms. I show that temporary shocks are relatively more important for low leverage firms, and that financial distress risk seems to be captured by the sensitivity of firms' cash flow innovations to market discount rate news.

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Marcelo Verdini Maia

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For Gabriel's Future.

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ABSTRACT

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What is the cross-sectional relationship between financial leverage and expected equity returns? How is the empirical relationship associated with firm's financial decisions? This dissertation investigates the potential explanations for the flatness relation between financial leverage and expected equity returns, and its link to firms capital structure determinants. Empirical evidence contradicts the theoretical prediction that leverage amplifies the equity risks. I decompose expected equity returns of book leverage portfolios according to their exposure to cash flow and discount rate risk. I find that low leverage firms have lower cash-flow beta and higher discount-rate beta than firms with high leverage. Although cash flow beta typically has a higher price of risk, book leverage portfolios load disproportionately on discount-rate beta, generating an essentially flat relation. Moreover, the main determinants of firms capital structures are related to firms sensitivities to these systematic sources of risk and have different importance for low and high leverage firms. I show that temporary shocks are relatively more important for low leverage firms, and that financial distress risk seems to be captured by the sensitivity of firms' cash flow innovations to market discount rate news.

Contents

List of Tables

Chapter 1

Introduction

The idea that financial leverage should be positively related to equity returns dates back to Modigliani-Miller's (1958 and 1961) famous Proposition II. This is an elementary notion in finance, where equity risk is formed by two fundamental risks: operating risk and financing risk. Given operating risk, average returns are increasing in leverage. That is, financial leverage amplifies the exposure of equities to priced systematic risks.

However, many empirical papers document that raw returns have a negative, or at least flat, relation with financial leverage, and that returns adjusted by traditional sources of risks have an even stronger negative relation with leverage.

These findings are usually seen as a puzzle. However, it is possible that market frictions lead low leverage firms to have greater exposures to systematic risks. For example, firms might optimally choose low leverage in response to greater exposure to systematic risks. Then, the amplification effect of leverage on equity risk could be either attenuated or dominated[1]. Consequently, identifying economic sources of risk that justify the empirical evidence concerning the relation between leverage and returns is an important issue and can help understand firms' financial decisions.

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[1] E.g. George and Hwang (2009).

The importance for investors of two sources of risk in the economy has been a topic of intense study in the asset pricing literature. Specifically, Campbell and Vuolteenaho (2004) argue that investors care about the permanent effects of future market's cash flow innovations and the transitory effects of the market's discount rate innovations. Bansal and Yaron (2004) show that investors care about long-run growth prospects and the level of economic uncertainty, and that changes in these fundamentals drive the risks in asset prices. Among other implementations, both approaches are successful in explaining the cross-sectional dispersion in asset prices and provide two distinct measures of systematic risk, usually called cash flow risk and discount-rate risk.

The main goal of this dissertation is to investigate empirically what can explain this puzzling cross-sectional relation between leverage and equity returns. Specifically, I argue that the flat (or sometimes negative) relation is a natural outcome of the association between firms' cash flow innovations and two distinct sources of systematic risk described above.

In fact, since firms' cash flow prospects are important for capital structure decisions, different shocks affecting firms' cash flows should also matter to determine capital structure of firms.

Although a capital structure decision is fundamentally important for stockholders' risk, leverage usually has not been considered as an important firm characteristic in the asset pricing literature. Papers generally concentrate on size, book-to-market, and industry portfolios since that these sorts produce economically meaningful risk premia. Moreover, some papers argue that size and book-to-market capture information contained in leverage[2]. However, it has been argued recently[3] that financial leverage is at the root of why size and book to market matter.

This work makes several contributions. First, I calculate the return sensitivities of portfolios sorted based on book leverage to the market cash flow and discount rate news. To do so, I implement the framework proposed by Campbell and Vuolteenaho (2004), through the use of the vector auto-regressive (VAR) approach. I find that firms with low leverage have lower cash-flow beta and higher discount-rate beta than firms with high leverage. Although cash flow beta typically has a higher price of risk, book leverage portfolios load disproportionately on discount-rate beta, generating an essentially flat relation between leverage and returns.

The amplification effect of leverage on equity risk, which comes naturally from the textbook intuition, seems to be dominated by greater exposure to systematic risk and different sensitivities of firms' returns should reveal information not captured by the single CAPM beta. In fact, for high leverage firms, both shocks may have roughly the same importance and, for low leverage firms, cash-flow beta is essentially zero.

To better characterize the association between leverage and cash-flow and discount-rate betas, I further decompose firms' return innovations into cash flow news and discount rate news, and calculate sensitivities of each firm's components to market news. I find that the high betas of low leverage stocks with the market's discount rate shocks and the high betas of high leverage firms with the market's cash flow shocks are determined by the properties of their cash flows. Specifically, the covariation between firm's news about cash flows and market innovations explains the positive relation between leverage and cash-flow beta and the negative relation between leverage and

[2]E.g., Chan and Chen (1991); Fama and French (1992); Chen and Zhang (1998)

[3]Ferguson and Shockley (2003), and Vassalou and Xing (2004)

discount rate beta.

The heterogeneity in betas among firms with different capital structures appears to be related with the effect of the type of systematic shocks on their cash flows. So, beyond the importance of earnings prospects for financial decisions, the effect of different shocks on cash flows might have important consequences on capital structure choices.

Usually, capital structure theory focuses on idiosyncratic risk to explain corporate financial decisions. For example, trade-off theory argue that firms with more volatile cash flows face higher expected costs of financial distress and should use less debt. More volatile cash flows reduce the probability that tax shields will be fully utilized, implying that higher risk should result in less debt. In contrast, this dissertation analyzes empirically how systematic risk is associated with capital structure decisions by investigating the relation between variables successfully used as leverage predictors and cash-flow betas.

I use cross-sectional firm-level regressions to identify whether the traditional cross-sectional leverage predictors are related with the different betas. That is, I study the determinants of risk exposures and their links to capital structure decisions on the entire sample and on the two extreme low and high leverage portfolios betas.

I use a parsimonious list of factors considered to have some influence on corporate leverage. This includes the variables proposed by Frank and Goyal (2007b). Also, I include both capital expenditures, as an alternative proxy for growth, and probability of default, to be extensively used as a direct proxy related to financial distress risk. The final set of variables is hence composed of profitability (ROA), unlevered z-score, tangibility, capital expenditures (capex), firm size, and book-to-market.

I show that an increase in profitability makes the cash flows riskier in response to temporary, sometimes high, shocks to market discount rate. This effect is pervasive for both extreme portfolios, but more pronounced for low leverage firms.

Furthermore, considering that a decrease in financial distress risk is associated both with lower probability of default and with more tangible assets, and that both underinvestment problem and asset substitution are more evident when firms go toward distress, the findings indicate that the sensitivity of firms' cash-flows to market discount-rate news is capturing exactly this risk, which is more pronounced for low leverage firms. In fact, probability of default matters only for low leverage firms, the effect of tangibility on risk is twice as higher than for high leverage firms, and the effects of book-to-market changes only affect low leverage firms.

Finally, I find that cash-flow shocks have relatively more importance for low leverage. Taking together, the results suggest that firms choose their capital structure in response to the systematic risks they face.

The rest of the dissertation is organized as follows. Chapter 2 briefly reviews the related literature. Chapter 3 presents the empirical framework that form a basis for this work. Chapter 4 contains descriptions of the data and results, showing how book leverage is related to cash-flow and discount rate risk. Chapter 5 presents the determinants of different betas and their link to capital structure factors. Chapter 6 concludes.

Chapter 2

Related Literature

This dissertation is related with studies that have directly examined the relationship between financial leverage and stock returns. This literature started with two seminal papers that are concerned primarily with the implications of Modigliani and Miller (1958 and 1961) proposition II.

Bandhari (1988) was the first study to investigate this proposition. He found that market leverage is positively related to expected equity returns, confirming the increasing in risk associated with high leverage. Fama and French (1992) also documented that market leverage is positively related to expected equity returns. In contrast, when book leverage is used as proxy, it is negatively related to equity returns, the so called financial leverage puzzle. However, Fama and French (1992) argue that book leverage captures both the effect of size and the effect of book-to-market. This claim relegated leverage to the second plan in the asset pricing literature, motivating follow-up papers to focus exclusively on size and book-to-market.

Recently, researchers looked more closely to the effects of financial leverage on equity returns. On the empirical side, Korteweg (2004) takes a time series approach and shows that, among firms performing exchange offers, equity factor loadings for highly levered companies are too low and find some supporting evidence from a simple trading strategy, involving firms with extreme levels of financial leverage. This result deepens the financial leverage puzzle and raises the question of why this happens.

Penman et al. (2006) take an accounting approach to test the relation between financial leverage and expected equity returns. They separate the leverage component of the book-to-market ratio pertaining to financing risk from the component that pertains to operations and observe an anomalous effect with respect to the leverage component.

Obreja (2007) builds his idea from the implications of Fama and French (1992) for the relation between book leverage and equity returns. He asks whether leverage contains information above and beyond size and book-to-market equity. The paper brings a structural model where the relative distribution of assets in place and growth options is the main determinant of equity risk premia. For all-equity-financed firms, this distribution can be summarized in terms of firm-specific productivity and two firm variables, namely book-to-market equity and firm size, but for firms financed with both equity and debt, this distribution depends also on financial leverage.

Firm size and book-to-market equity cannot capture the cross-sectional variation in equity returns due to financial leverage. Leveraged firms are riskier because they are stuck with too much capital, during times of low productivity. These firms cannot scale down production without increasing the likelihood of default. The model can generate qualitatively and, sometimes, quantitatively the cross-sectional properties of equity returns associated with firm characteristics such as book-to-market equity, firm size, market leverage, book leverage and debt/equity ratio.

George and Hwang (2009) also document that the relation between leverage and returns is negative. They build a simple model specified to solve the distress and leverage puzzles, examining the endogenous relation between leverage and financial distress costs. They hypothesize that low (high) leverage can be used as an indicator of exposure to greater (lesser) financial distress costs. This implies that if financial distress risk is priced with a return premium for high cost firms, then expected returns will be higher for low leverage firms than for high leverage firms.

Gomes and Schmid (2009) propose a theoretical interpretation for the apparently contradictory empirical evidence. Because of the endogenous relation between leverage and investment, high leverage firms in their model tend to be more mature firms with more book assets and fewer growth opportunities; that is, they should produce less risk. A coherent parametrization of their model can replicate the actual relation. Also, using a real options model, they show that firms' equity beta only increases with financial leverage in a static world in which leverage is exogenously determined[1].

I add to this debate by documenting that the empirical relation between book leverage and stock returns is flat, and arguing that firms with different leverage ratios have different exposures to the market's systematic risks. Also, I document that the different sensitivities to market news are implied by the characteristics of firms' cash-flows. Moreover, these different sensitivities are determined by factors extensively studied in the capital structure literature.

This study is also related to the return decomposition literature, which focuses on understanding the systematic risks affecting stock returns. Although most of this literature is concerned in developing new implementations to explain asset pricing anomalies (Campbell and Vuolteenaho (2004), Campbell et al (2009), Chen and Zhao (2009a, 2009b), Da and Waracka (2009), Bansal, Dittmar, and Lundblad (2004)), here I am interested in understanding how cash-flow and discount-rate sensitivities

[1]Nielsen (2006) study the relationship between companies' choice of capital structure and their stock market returns from a corporate governance perspective.

are related to book leverage by applying the predictions of a standard framework. Although the spread between low and high leverage portfolios seems not to be large enough to be interesting for an asset pricing perspective, the flat (negative) relation constitutes a puzzle and should be informative about underlying factors affecting capital structure decisions.

It has been documented in the asset pricing literature that investors are fundamentally concerned with two sources of risk in the economy. In fact, since stocks are priced by discounting their expected future cash flows, it is natural to think that movements in stock prices are driven both by news about cash flows and discount rates. Therefore, understanding how economic fundamentals drive these changes is of crucial importance.

Campbell and Vuolteenaho (2004) argue that investors care (more) about the permanent effects of future market's cash flow innovations and the transitory effects of market's discount rate innovations. Specifically, the required return on a stock is determined not by its overall CAPM beta, but by two separate betas, one with permanent shocks to market cash flows (cash-flow beta), and other with temporary shocks to market discount rates (discount-rate beta). They show, for example, that the high average return on value stocks is predicted by the two-beta model[2] .

Bansal and Yaron (2004) demonstrate that investors care about long-run growth prospects and the level of economic uncertainty, and that changes in these fundamentals drive risks in asset prices. Current shocks to expected growth alter expectations concerning future economic growth not only in the short run but also for the very long run. Also, they argue that time variation in expected excess returns is due to

[2]Koubouros, Malliaropulos, and Panopoulou (2005) extend the approaches of Campbell and Vuolteenaho (2004), and Campbell et al (2009), demonstrating that these approaches can account for the size effect as well.

variation in economic uncertainty.

Bansal, Dittmar, and Lundblad (2002 and 2004) study Bansal and Yaron's implications for the cross-sectional differences in mean returns across assets. They show that systematic risks in cash flows can account for the cross-sectional differences in risk premia of assets, accounting for the puzzling value, size, and momentum spread in the cross section of assets.

All of these approaches are based on the return decomposition framework, differing only in their implementation. Campbell and Vuolteenaho (2004) explore the return predictability. On the other hand, Bansal, Dittmar and Lundblad (2004) explore the cash flow (dividends) predictability.

Finally, this paper contributes to the empirical capital structure literature concerned with studying the cross-sectional differences in financial leverage. As summarized by Frank and Goyal (2007a and 2007b), the study of the determinants of capital structure is of fundamental importance because reliable factors explain only 25% of firms' heterogeneity. The contribution of this dissertation is to suggest that different cash-flow sensitivities to market innovations seem to add to possible explanations of what determines the heterogeneity of firms' capital structure, guiding future development in this literature.

There are some papers which share their ideas with this dissertation. First, Hackback, Miao, and Morellec (2006) contend that macroeconomic conditions should have a large impact not only on credit risk but also on firms financing decisions. Indeed, if one determines optimal leverage by balancing the tax benefit of debt and bankruptcy costs, then both the benefit and the cost of debt should depend on macroeconomic conditions. The tax benefit of debt obviously depends on the level of cash flows, which in turn should depend on whether the economy is in an expansion or in a contraction. In addition, expected bankruptcy costs depend on the probability of default and the loss given default, both of which should depend on the current state of the economy. As a result, variations in macroeconomic conditions should induce variations in optimal leverage. The purpose of their paper is to provide a first step towards understanding the quantitative impact of macroeconomic conditions on credit risk and capital structure decisions.

Recently, two other papers explore theoretically the effects of different shocks on firm's cash flows and their implication for capital structure decisions. Chen (2009) introduces macroeconomic conditions into firms' financing decisions and builds a structural model showing how business cycles affect financing decisions and the pricing of corporate securities. Gorbenko and Strebulaev (2009) investigate corporate financial policies in the presence of both temporary and permanent idiosyncratic shocks to cash flows, and show that temporary shocks seem to be more important to explain empirical stylized facts about corporate financial decisions.

This dissertation similarly finds that different systematic risks on firm's cash flows might be informative about capital structure decisions, providing empirical evidence for these papers and directly investigating how the effect of shocks to firm's cash flows are related to the heterogeneity of capital structure between firms.

Chapter 3

Empirical Framework

3.1 Return Decomposition

Starting from the accounting definition of asset returns, Campbell and Shiller (1988) and Campbell (1991)[1] show that log returns can be decomposed into two components:

$$r_{t+1}-E_t r_{t+1} = (E_{t+1}-E_t)\sum \rho^j \Delta d_{t+1+j} - (E_{t+1}-E_t)\sum \rho^j r_{t+1+j} = N_{CF,t+1}-N_{DR,t+1} \tag{3.1}$$

where r_{t+1} is a log stock return, d_{t+1} is the log dividend paid, Δ denotes a one period change, E_t denotes a rational expectation at time t, ρ is a discount coefficient, $N_{CF,t+1}$ denotes cash flow news, and $N_{DR,t+1}$ denotes discount rate news (or expected returns).

This decomposition is an identity and holds independent of the underlying model for expected returns. It shows that unexpected stock returns must be associated with changes in expectations for future cash flows and/or discount rates. An increase in expected future cash flows is associated with a capital gain today, while an increase in discount rates is associated with capital loss today.

It can be demonstrated empirically that these two components display substantial volatility and are not highly correlated with one another. This finding allows using

[1] Details can be found in Campbell and Vuolteenaho (2004), and Campbell et al. (2009), for example.

the return decomposition to construct different measures of stocks' systematic risks. That is, if equation (3.1) is used to decompose aggregate market returns, the CAPM beta is given by the sum of two betas, the market cash-flow beta and the market discount-rate beta, respectively:

$$\beta_{i,CF_M} = \frac{Cov(r_{i,t}, N_{CF_M,t})}{Var(r^e_{M,t} - E_{t-1}r^e_{M,t})} \tag{3.2}$$

$$\beta_{i,DR_M} = \frac{Cov(r_{i,t}, -N_{DR_M,t})}{Var(r^e_{M,t} - E_{t-1}r^e_{M,t})} \tag{3.3}$$

where $\beta_{i,M} = \beta_{i,CF_M} + \beta_{i,DR_M}$.

Although the sum of the market cash-flow beta and the market discount-rate beta is equal to the CAPM beta, they carry different risk premia, providing two potentially different sources of risk. From ICAPM, one can show that:

$$E_t[R_{i,t+1}] - R_{f,t+1} = \gamma\sigma^2_{M,t}\beta_{i,CF_{M,t}} + \sigma^2_{M,t}\beta_{i,DR_{M,t}}, \tag{3.4}$$

where γ is the investor's coefficient of risk aversion and σ^2_M is the variance of the aggregate market returns.

3.2 Traditional Vector Autoregressive Implementation

How to implement the calculation of these betas is still a topic on intense debate, since the news components are not directly observable. Here I follow the implementation of Campbell and Vuolteenaho (2004) and Campbell et al (2009) both of whom use the vector autoregressive (VAR) approach to disentangle cash-flow and discount-rate shocks at market and firm levels. They build on the fact that returns are predictable and one only needs to understand their dynamics, not the short-run dynamics of dividends.

Chen and Zhao (2009) question this implementation, offering arguments showing that it is not quite robust. It is not my intention to take a side in this disagreement. To alleviate any concerns about the validity of my results, I also implement the calculation of betas using alternative measures commonly seen in the literature.

The first step, then, is to decompose the CAPM beta by calculating market cash flow and discount rate news. The VAR methodology first estimates the terms $E_t r_{t+1}$ and $N_{DR,t+1}$ and then uses r_{t+1} and equation (3.1) to back out the cash flow news.

Specifically, one can assume that the data are generated by a first-order VAR model

$$z_{t+1} = a + \Gamma z_t + u_{t+1} \tag{3.5}$$

where z_{t+1} is a N-by-1 state vector with r_{t+1} as its first element, a and Γ are N-by-1 vector and N-by-N matrix of constant parameters, and u_{t+1} is an i.i.d N-by-1 vector of shocks. Thus:

$$N_{DR,t+1} = e1'\lambda u_{t+1} \tag{3.6}$$

$$N_{CF,t+1} = (e1' + e1'\lambda) u_{t+1} \tag{3.7}$$

where $\lambda \equiv \rho\Gamma(I - \rho\Gamma)^{-1}$ and $e1$ is the canonical vector.

Campbell and Vuolteenaho (2002) argue that returns generated by cash-flow news are never reversed subsequently, whereas returns generated by discount rate news are offset by lower returns in the future. That is, the two beta decomposition suggests that there are both a permanent (or long-run) risk and a transitory (or short-run) risk not captured by the single CAPM beta. Therefore, conservative long-term investors are more concerned with cash-flow risk than with discount rate risk. In other words, for pricing, the sensitivity of an asset to market cash flow risk is more, but not exclusively, important, and, in general, returns should be positively related to cash-flow beta, as derived in equation (3.4). The relevance of this method is the possibility of extracting two different movements in the market dynamics that could potentially affect firms' returns, and that were potentially hidden in the single CAPM beta.

Note that this implementation only decomposes the market return into two components. This decomposition generates the broad definition of cash-flow and discount-rate beta. To better understand firms' sensitivities to market innovations, it is necessary to investigate whether and how firms' components are related to the two market sources of risk. Specifically, I follow the approach of Campbell, Polk and Vuolteenaho (2009) and further decompose each firm's returns into their two news components. That is:

$$r_{i,t+1} - E_t r_{i,t+1} = (E_{t+1} - E_t) \sum \rho^j \Delta d_{i,t+1+j} - (E_{t+1} - E_t) \sum \rho^j r_{i,t+1+j} = N_{i,CF,t+1} - N_{i,DR,t+1} \tag{3.8}$$

The following four betas can thus be defined:

$$\beta_{CF_i,CF_M} = \frac{Cov(N_{CF_{i,t}}, N_{CF_{M,t}})}{Var(r^e_{M,t} - E_{t-1} r^e_{M,t})} \tag{3.9}$$

$$\beta_{CF_i,DR_M} = \frac{Cov(N_{CF_{i,t}}, -N_{DR_{M,t}})}{Var(r^e_{M,t} - E_{t-1} r^e_{M,t})} \tag{3.10}$$

$$\beta_{DR_i,CF_M} = \frac{Cov(N_{DR_{i,t}}, N_{CF_{M,t}})}{Var(r^e_{M,t} - E_{t-1} r^e_{M,t})} \tag{3.11}$$

$$\beta_{DR_i,DR_M} = \frac{Cov(N_{DR_{i,t}}, -N_{DR_{M,t}})}{Var(r^e_{M,t} - E_{t-1} r^e_{M,t})} \tag{3.12}$$

There is some confusion about how to denominate these six betas. Many papers call $\beta_{CFi,CFM}$ cash-flow risk, because they only focus on understanding its relevance for pricing. To avoid confusion, I use the following nomenclature. β_{CF_i,CF_M}: Cash-flow cash-flow risk , β_{CF_i,DR_M}: Cash-flow discount rate risk, β_{CF_i,DR_M}: Discount rate cash-flow risk, and β_{DR_i,DR_M}: Discount rate discount rate risk. Then, equations (3.9) and (3.10) define the two firms' cash-flow risks, and equations (3.11) and (3.12) define firms' discount rate risks. Finally, cash-flow beta and discount-rate beta are defined as follows:

$$\beta_{i,CF_M} = \beta_{CF_i,CF_M} + \beta_{DR_i,CF_M} \tag{3.13}$$

$$\beta_{i,DR_M} = \beta_{CF_i,DR_M} + \beta_{DR_i,DR_M} \tag{3.14}$$

It must be noted that the widespread use of these two (four) beta decompositions serves to explain the apparent anomalies posed by value, small and momentum stocks. In regard to these stocks, a large spread between returns of extreme portfolios and an inverse relation to market beta generates an asset pricing puzzle, constituting a potential interesting research topic itself. Leverage has not been a subject of study in the asset pricing literature because sorts based on book leverage do not produce meaningful risk premia. Moreover, some papers argue that size and book-to-market capture information contained in leverage.

However, what I am examining here is the puzzling fact that, although financial leverage is a fundamental characteristic of a firm, the object of an optimal decision by management, it apparently plays an innocuous role in increasing equity risks, as firms become more leveraged.

Thus, it seems interesting to analyze how leverage is associated with market cash flow and discount rate risks. Indeed, when firms gear up, shocks affecting their cash flows become even more important for capital structure decisions. Recall that each market news component should be capturing different systematic risks, which generally have distinct effects on firms. This idea is explored in the next chapter.

3.3 Alternative Implementations

The VAR methodology used to implement the calculation of both firms' and market news allows calculating the effect of today's shocks over the discounted infinite future, capturing the correct effect from changes in investors' expectations of prices and returns. However, as discussed above, the best implementation method is still under debate.

To alleviate any concern about the results obtained in the last section, I use alternative measures to estimate cash-flow and discount-rate betas: long run risk model (as in Bansal, Dittmar, and Lundblad (2004)), as well as direct methods. I choose proxies used extensively in the literature that have proved successful in explaining the facts under consideration.[2] It should be noted that the methods developed in the literature do not completely determine the two (four) betas. For example, the long-run risk model implemented in this dissertation (Bansal et al. (2004)) focuses on what they called cash-flow betas (sensitivities of firms'cash flow innovations to market cash flow news).

The long run risk model explores the fact that cash-flows seem to be better predicted than returns. This model differs from the method used in this paper in estimating first discount rate news. The VAR methodology is used to estimate directly cash flow news. The original implementation assumes that the de-meaned log consumption growth follows a simple AR(1):

$$g_{c,t} = \rho_c g_{c,t-1} + \eta_t \tag{3.15}$$

[2]It is not the main goal of this dissertation provides an extensive implementation of these alternative methods. For example, one can apply entirely the long-run risk implementation in a new paper. Here, it is partially used as a robustness check. I do not provide the details. Please see the cited papers.

with η_t being the consumption news at date t, and $g_{c,t}$ is the de-meaned log consumption growth.

Further, it is assumed that the relationship between de-meaned dividend and consumption growth rate is:

$$g_{i,t} = \phi_i(\frac{1}{K}\sum_{k=1}^{K} g_{c,t-k}) + u_{i,t} \tag{3.16}$$

$$u_{i,t} = \sum_{j=1}^{L} \rho_{j,t} u_{i,t-j} + \varepsilon_{i,t} \tag{3.17}$$

Thus, equations (3.15), (3.16), and (3.17) are mapped into a VAR(1), and in a algebraic process similar to the one that generated equations (3.6) and (3.7), one can represent the innovation to current and expected future cash-flow growth rates. The exposure of this innovation to consumption growth is the firms' cash flow innovation to consumption growth.

I use a method similar to this one. Instead of using the VAR method, the sensitivities of portfolios' cash flow innovation to market cash flow news is given by:

$$\sum_{j=1}^{N} \rho^j g_{i,t+j,j+1} = \alpha + \beta_{CFi,CFM} \sum_{j=1}^{N} \rho^j g_{M,t+j,j+1} + \epsilon \tag{3.18}$$

where $g_{i,t+j,j+1}$ is the log de-meaned dividend growth for portfolio i at date t+j.

The measurement of dividends for each portfolio is the following. From the accounting definition of returns, we have:

$$R_{i,t} = h_{i,t+1} + y_{i,t+1} \tag{3.19}$$

where $h_{i,t}$ is the price appreciation and $y_{i,t}$ is the dividend yield. Then, for each portfolio i, the level of dividends is:

$$D_{i,t+1} = y_{i,t+1}V_{i,t} \tag{3.20}$$

$$V_{i,t+1} = h_{i,t+1}V_{i,t} \tag{3.21}$$

where $V_0 = 1$, $D_{i,t+1}$ is the total cash dividends paid out by a portfolio at time t that extracts the dividends and reinvests the capital gains.

The direct methods use the portfolio-level accounting return on equity (ROE) as a proxy for cash flows. Campbell, Polk and Vuolteenaho (2009) and Cohen, Polk, and Vuolteenaho (2003, 2009) argue that the discounted sum of ROE is a good measure of firm-level cash-flow fundamentals. Thus, a ROE-based proxy for portfolio level cash-flow news is the following:

$$N_{i,CF,t+1} = \sum_{j=1}^{N} \rho^{j-1} roe_{i,t,t+j} \tag{3.22}$$

where $roe_{i,t,t+j}$ is the log of real profitability for portfolio i, sorted in year t, and measured in year t+j.

To proxy for discount-rate news at the market level, I use the proxy derived in Campbell, Polk and Vuolteenaho (2009):

$$-N_{M,DR,t+1} = \sum_{j=1}^{N} [\rho^{j-1} \Delta_{t+j} ln(P/E)_M] \tag{3.23}$$

To emphasize log term trends in cash flows, I examine horizons (N) from two to five years for both methods (log run risk model and direct methods).

Chapter 4

Data and Results

The primary data and the methodology of variable construction are quite standard. Data is obtained from CRSP and Compustat. Monthly returns and market capitalization are from CRSP, and financial information and other firms' characteristics are from the CRSP/Compustat merged database. Observations with missing values for variables used directly in the study are excluded. Financial and utilities industry are excluded, as are stocks of firms with non-positive book value of equity and/or negative total liabilities. Moreover, to eliminate likely data errors, I discard those firms with book-to-market (BE/ME) lower than 0.01 and greater than 100 at the time of the sort.

To correct for survival bias, I only include stocks that have been in Compustat for more than two years, and restrict the sample to common stocks. When necessary, I describe any change in the data, in the sample and in the implementation used. Variable construction and other details can be found in the appendix.

This work studies risk characteristics of portfolios sorted by book leverage. I choose book leverage as a proxy for financial leverage primarily because book leverage seems to capture the endogenous decision of managers about capital structure[1].

[1]One can explore the same implementation for market leverage. However, this proxy is mechan-

The construction takes place as follows. Portfolios are formed on July 1st every year (t) and run through June 30th of the next year ($t+1$) based on Compustat and CRSP data for each firm as of December of the previous year ($t-1$). Book leverage portfolios are created by sorting on NYSE stocks only and then using the break points for all NYSE, Amex and NASDAQ stocks. I use monthly value-weighted excess returns (over 30 day T-bill) averaged over all months and years. I included the bias correction for delisted firms suggested by Shumway (1997) and Shumway and Warther (1999).

Table 4.1 shows some characteristics of these portfolios. To save space and to focus on the differences between low and high leverage firms, statistics are only shown for all firms and for the two extreme portfolios. A quick look reveals several unsurprising differences. High leverage firms tend to be larger (both by book value of assets and market capitalization), have fewer growth opportunities (i.e., higher book-to-market), have more tangible assets, have more collateral, invest more and have higher probability of default. It is interesting to note, however, that both portfolios tend to have similar returns on assets (dividends are roughly the same for these portfolios).

In panel A of table 4.2, I document that the relation between excess returns and book leverage is essentially flat, confirming the results of past empirical studies. The average difference between returns of the two extreme portfolios is only 0.02% and statistically insignificant. This result is at odds with traditional theories. Intuitively, financial leverage amplifies the exposure of equity to priced systematic risks, so financial leverage should be positively related to stock returns

In addition to this, I provide evidence that excess returns of portfolios sorted by book leverage and book-to-market also are inversely related to financial leverage,

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ically related to returns, by definition.

Table 4.1: Summary Statistics

The sample consists of all nonfinancial, non-utility firms in the Compustat database from 1965 to 2006. The table presents variable averages, medians (in brackets), and standard deviations (SD) for the entire sample (All Firms), as well as the subsample of firms for the extreme lowest (L) and highest (H) book leverage portfolios. The variable definitions are provided in the Appendix.

	All firms		L		H	
Variable	Mean [Median]	(SD)	Mean [Median]	(SD)	Mean [Median]	(SD)
Book Leverage	0.23 [0.22]	(0.17)	0.01 [0.002]	(0.02)	0.36 [0.33]	(0.12)
Market Leverage	0.26 [0.22]	(0.23)	0.02 [0.00]	(0.03)	0.42 [0.40]	(0.20)
ROA	0.12 [0.13]	(0.16)	0.10 [0.15]	(0.24)	0.11 [0.13]	(0.11)
Unlevered Z-score	2.08 [2.30]	(2.01)	2.16 [2.77]	(2.88)	1.90 [2.00]	(1.55)
Tangibility	0.33 [0.29]	(0.21)	0.23 [0.18]	(0.19)	0.38 [0.34]	(0.22)
Collateral	0.53 [0.56]	(0.21)	0.39 [0.39]	(0.23)	0.59 [0.61]	(0.18)
Total Assets	1022 [93]	(4826)	252 [43]	(2339)	1227 [123]	(5186)
Market Cap.	991 [67]	(6720)	679 [64]	(8020)	872 [59]	(5009)
Capex	0.07 [0.06]	(0.07)	0.06 [0.05]	(0.06)	0.08 [0.06]	(0.07)
Book-to-Market	1.18 [0.70]	(3.51)	0.78 [0.53]	(1.65)	1.33 [0.79]	(3.87)

confirming the evidence presented in George and Hwang (2009) and Penman et al. (2006). They demonstrate that book-to-market is not able to capture all of the information contained in leverage, and that, if one controls the return by risks extracted using the standard Fama-French model, the inverse relation becomes even stronger.

To derive the cash-flow and discount rate betas, we need to estimate the market's cash flow and discount-rate innovations, as in equations (3.6) and (3.7). To operationalize the VAR method, the literature assumes that the vector z is composed of four state variables chosen by their power and by their success in predicting future returns. They are the excess market return, the yield spread between long-term and short-term bonds, the market's smoothed price-earnings ratio, and the small-stock value spread, measured as the difference between the log(Book Equity/Market Equity) of the small high-book-to-market portfolio and the log(Book Equity/Market Equity) of the small low-book-to-market portfolio.

Shortly, the intuition for these variables is the following. The yield curve tracks the business cycle. High price-earnings ratios will necessarily imply low long-run expected returns, if expected earnings growth is constant. If small growth stocks have low expected returns and small value stocks have high expected returns, and this return differential is not explained by the CAPM betas, the ICAPM requires the small growth stock returns to predict lower future market returns and small value stocks returns to predict higher future market returns.

For the VAR estimation, I use monthly observations for returns and state variables covering the period between 1929:1 to 2006:12. The data for VAR implementation is taken from John Campbell's website (which covers the period between 1929:1 to 2001:12) and extended to 2006:12. I have also estimated this VAR for the shorter period of 1965-2006, the sample period for the primary dataset. Since the goal is

Table 4.2: Excess Returns for Book Leverage Portfolios

The sample consists of all nonfinancial, non-utility firms in the annual Compustat database between 1965 and 2006. Prices, shares outstanding and returns are from CRSP. The table presents excess returns, in percentage points, calculated as the monthly average of value-weighted portfolio returns in excess of 30 day T-bill rates. L represents the portfolio with the lowest book leverage, H represents the portfolio with the highest leverage, G represents the growth portfolio, and V represents the value portfolio. In panel A, portfolios are formed by a single sorting based on book leverage. In panel B, portfolios are formed by a double sorting based on book leverage and book-to-market. Standard errors are in parentheses. All variables are defined in the Appendix.

Panel A: Excess Returns for Portfolios Sorted Based on Book Leverage

	L	2	3	4	H	H-L
Excess Return	0.49	0.53	0.55	0.55	0.51	0.02
						(0.046)

Panel B: Excess Returns for Portfolios Sorted Based on Book Leverage and Book-to-Market

	G (growth)	2	3	4	V (value)
L (low)	0.43	0.52	0.57	0.71	0.68
2	0.32	0.70	0.60	0.60	0.70
3	0.40	0.53	0.67	0.50	0.57
4	0.65	0.33	0.56	0.43	0.63
H (high)	0.35	0.50	0.37	0.52	0.57
H-L	-0.08	-0.02	-0.20	-0.19	-0.09
	(0.037)	(0.041)	(0.083)	(0.085)	(0.042)

to recover market news, I decided to make use of data availability to extract all information. The estimation does not alter the results, which are available upon request[2].

The right choice of these variables is essential for the VAR implementation to be correct. Chen and Zhao (2009) estimate several other reasonable VARs that imply lower bad betas for value stocks than for growth stocks, exactly the opposite of Campbell and Vuolteenaho's (2004) results, casting doubt on the validity of their approach.

Specifically, Chen and Zhao show that value stocks have lower bad betas than do growth stocks in recent data if a valuation ratio is excluded from the VAR system, or if the log price-smoothed earnings ratio is replaced by either the log price-earnings ratio using current one-year earnings without smoothing, the level of the dividend-price ratio or the level of the book-to-market ratio. Campbell et al. (2009) comment on their results and observe, among other things, that Chen and Zhao's specifications merely verify Campbell and Vuolteenaho's (2004) report that a VAR system must include an aggregate valuation ratio with predictive power for the aggregate market return if it is to generate a higher bad beta for value stocks than for growth stocks. That is, for the VAR approach to be successful, one must use the state vector described above.

Table 4.3 reports parameter estimates for the aggregate VAR model. The magnitudes and significance of each parameter are consistent with previous findings in the literature and were extensively discussed in Campbell and Vuolteenaho (2004). The first row of the table shows that all four VAR state variables have some ability to

[2]Campbell and Vuolteenaho (2004) provides many robustness checks for this VAR implementation.

Table 4.3: Aggregate VAR Estimates

This table shows the OLS parameter estimates for a first-order VAR model including a constant, the log excess market return (R_M), term yield spread (TY), price-earnings ratio (PE), and small-stock value spread (VS). Each pair of rows corresponds to a different dependent variable. The first five columns report coefficients on the five explanatory variables, and the remaining column show R^2 statistics. OLS standard errors are in brackets. The sample period for the dependent variables is 1929:1-2006:12, comprising 935 monthly data points.

	constant	$R_{M,t}$	TY_t	PE_t	VS_t	$R^2(\%)$
$R_{M,t+1}$	0.064	0.095	0.005	-0.016	-0.011	2.51
	[0.019]	[0.032]	[0.003]	[0.005]	[0.005]	
TY_{t+1}	0.040	-0.003	0.911	-0.020	0.048	85.15
	[0.095]	[0.160]	[0.013]	[0.025]	[0.026]	
PE_{t+1}	0.023	0.516	0.001	0.992	-0.003	99.07
	[0.013]	[0.021]	[0.002]	[0.003]	[0.004]	
VS_{t+1}	0.018	0.001	-0.000	-0.002	0.992	98.44
	[0.017]	[0.028]	[0.002]	[0.004]	[0.005]	

predict excess returns on the aggregate stock market.

In table 4.4, the betas are calculated for single sorted portfolios based on book leverage, revealing that high leveraged stocks have higher cash-flow betas than low leveraged stocks, but lower discount-rate betas. The difference in cash-flow betas between the extreme portfolios is 0.091 and statistically significant. On the other hand, discount-rate betas are higher for low leverage stocks than for high leverage stocks. The difference between the extreme portfolios is economically large (-0.27) and statistically significant.

The results above seem interesting. First, it should be noticed it is not necessarily

Table 4.4: Cash Flow and Discount Rate Betas for Book Leverage Portfolios

The table reports cash flow and discount rate betas using market innovations $N_{M,CF_{t+1}}$ and $N_{M,DR_{t+1}}$ extracted using the estimates of the aggregate VAR. The sample consists of all nonfinancial, non utility firms in the annual Compustat database between 1965 and 2006. Prices, shares outstanding and returns are from CRSP. $\beta_{i,CFM} = \frac{Cov(r_{i,t+1}, N_{M,CF_{t+1}})}{Var(r_{M,t+1})}$ and $\beta_{i,DRM} = \frac{Cov(r_{i,t+1}, N_{M,-DR_{t+1}})}{Var(r_{M,t+1})}$. In panel A, quintile portfolios are formed each year by sorting firms on year t book leverage. The portfolio i=L is the extreme low leverage portfolio and i=H is the extreme high leverage portfolio. H-L represents the difference between extreme high and low leverage portfolios. The standard errors are in parentheses, estimated using the Newey-West method with five lags.

	L	2	3	4	H	H-L
$\beta_{i,CFM}$ (Cash-Flow Beta)	-0.007	0.045	0.065	0.078	0.084	0.091
	(0.03)	(0.025)	(0.026)	(0.027)	(0.024)	(0.03)
$\beta_{i,DRM}$ (Discount Rate Beta)	1.13	0.95	0.87	0.88	0.86	-0.27
	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.10)

true that, for every portfolio formation based on firms' characteristics one needs to obtain the same pattern, as one might suspect. Specifically, other studies report similar patterns to those obtained here for portfolios sorted on size and book-to-market, and argue that the results help to explain common asset pricing anomalies.

It is possible to produce, for example, a spread only in discount-rate betas but no spread in cash-flow betas, for portfolios sorted on past market beta. The former portfolio formation creates the same flat pattern in returns as does book leverage sorting.

Second, although cash flow risk typically has a higher price of risk, book leverage portfolios load disproportionately on discount-rate beta, generating an essentially flat relation between leverage and returns. This result suggests that the amplification effect of leverage on equity risk, which comes naturally from the textbook intuition, seems to be dominated by greater exposure to systematic risks.

In fact, different sensitivities of firms' returns might reveal information not captured by the single CAPM beta, and the flat relation between financial leverage and expected equity returns is more informative than suspected so far. Indeed, as already noticed before, cash-flow beta seems to capture permanent (or long run) effects on returns, and discount rate beta seems to capture transitory (or short-run) effects on returns. Hence, two interesting facts should be observed. First, for higher leverage firms, cash-flow betas have an increasing importance, tending to have the same importance as discount-rate beta (depending on the value of the coefficient of risk aversion). That is, they suffer both from transitory shocks and from permanent shocks. Second, for low leverage firms, cash-flow beta is essentially zero. That is, only temporary shocks in the economy matter for those firms.

In table 4.5, betas are calculated for 25 portfolios double-sorted by book leverage

Table 4.5: Cash Flow and Discount Rate Betas for Book Leverage and Book to Market Portfolios

The table reports cash flow and discount rate betas using market innovations $N_{M,CF_{t+1}}$ and $N_{M,DR_{t+1}}$ extracted using the estimates of the aggregate VAR. The sample consists of all nonfinancial, non utility firms in the annual Compustat database between 1965 and 2006. Prices, shares outstanding and returns are from CRSP. $\beta_{i,CFM} = \frac{Cov(r_{i,t+1}, N_{M,CF_{t+1}})}{Var(r_{M,t+1})}$ and $\beta_{i,DRM} = \frac{Cov(r_{i,t+1}, N_{M,-DR_{t+1}})}{Var(r_{M,t+1})}$. 25 portfolios are formed each year by sorting firms on year t book leverage and year t book to market. The book-to-market used in sorts is computed as year t-1 book equity divided by end of June year t market equity. The portfolio i=L is the extreme low leverage portfolio and i=H is the extreme high leverage portfolio. H-L represents the difference between extreme high and low leverage portfolios. The portfolio i=G is the extreme growth and i=V is the extreme value portfolio. The standard errors are in parentheses, estimated using the Newey-West method with five lags.

	Cash flow beta					Discount rate beta				
	G	2	3	4	V	G	2	3	4	V
L	0.00	-0.02	-0.00	0.02	0.05	1.23	1.16	1.05	1.02	0.96
2	-0.01	0.03	0.08	0.04	0.07	1.14	1.08	0.97	0.99	0.80
3	0.03	0.05	0.10	0.08	0.08	1.10	1.07	0.88	0.97	0.76
4	0.03	0.08	0.08	0.07	0.10	1.04	0.84	0.94	0.89	0.70
H	0.06	0.09	0.10	0.07	0.11	1.18	0.98	0.93	0.92	0.75
H-L	0.06	0.11	0.10	0.05	0.06	-0.05	-0.18	-0.12	-0.10	-0.21
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.05)

and book-to-market. Many authors have argued that book-to-market captures the information on leverage. Specifically, many papers link value firms with large leverage and growth firms with low leverage. Recently, however, two papers have examined the effects of leverage on asset prices that occur independently of their book-to-market ratio. Here, the same pattern is obtained, as in table 4.4. The cash-flow and discount-rate beta spread is more pronounced for value firms, but for every level of book-to-market, high leverage stocks have higher cash-flow betas and lower discount-rate betas than low leverage stocks.

To summarize, the returns of low leverage firms appear to react only to temporary systematic shocks, captured by discount-rate betas, and returns of high leverage firms appear to react both to temporary systematic shocks and to permanent systematic shocks, captured by cash-flow betas.

Thus, to better characterize the association between leverage and cash-flow and discount-rate betas, I further decompose firms' return innovations into cash flow news and discount rate news, and calculate the sensitivities of each firm's components to market news.

As in the aggregate VAR, it is necessary to extract firms' components. Among the different implementations used in the literature, I use firm-level annual observations to estimate the VAR[3]. That is, the three-state-variables vector used is: log firm-level return (r_i), log "transformed" book-to-market ratio, and log "transformed" firm profitability (ROE). Log firm-level return is the annual log value-weighted return on a firm's common stocks, compounded from monthly returns (from the beginning of June to the end of May). Log book-to-market is transformed to avoid influential observations. Thus the log "transformed" book-to-market ratio is defined as $log(0.9BE_{t-1} +$

[3]I follow closely the same implementation as in Campbell et al. (2009).

Table 4.6: Firm Level VAR estimates

This table shows the pooled-OLS parameter estimates for a first-order firm-level VAR model. The model state vector includes the log stock return (r), log book-to-market (BM), and log profitability (roe). All three variables are market adjusted, r by subtracting CRSP value weighted returns and BM and roe by removing the respective year-specific cross-section mean. Standard errors (in parentheses) take into account clustering in each cross-section. The sample period for the dependent variables is 1965 to 2006, 58373 firm-years.

	$r_{i,t}$	BM_t	roe_t	$adj.R^2$
$r_{i,t+1}$	0.066	0.060	0.037	1.10%
	(0.030)	(0.024)	(0.018)	
BM_{t+1}	0.068	0.840	0.027	71.70%
	(0.0539)	(0.073)	(0.07)	
roe_{t+1}	0.163	-0.040	0.366	21.78%
	(0.006)	(0.006)	(0.05)	

$0.1ME_t)/ME_t)$, where BE_{t-1} is book equity for the fiscal year ending in calendar year t-1, and ME_t is the market equity at the end of May of year t. Log profitability is also transformed and, hence, defined as $log(1 + NI_t/(0.9BE_{t-1} + 0.1ME_t))$, where NI_t is the firm's net income in year t. This firm-level VAR can be estimated through pooled regressions.

Parameter estimates and errors generate market-adjusted cash flow and discount rate news. Campbell et al. (2009) observe that one can use pooled regressions when working with an unbalanced panel, where the average number of firms is much greater than the number of annual observations. Conditioning on survival could bias estimates. Therefore, it is assumed that the VAR transition matrix is equal for all firms.

Table 4.6 presents the results for the firm level VAR. The coefficients found are in line with the literature. I make use of the coefficient matrix to recover firms' cash flow and discount rate news[4]

Table 4.7 show that the high (low) betas of low leverage stocks with the market discount rate (cash-flow) shocks are determined by the properties of their cash flows. That is, the cross-sectional differences in sensitivities among leverage portfolios are determined by firms' cash flow exposures to market innovations. The sensitivity of discount rate innovations to market discount rate innovations is equally important for all firms, and its magnitude is essentially the same for all portfolios.

These findings capture an important effect usually not examined in studies of capital structure decisions. Generally, papers pay attention to the permanent impacts on cash flows. Here, the short-run impact on cash flows seems to be relatively more important for firms.

Indeed, the cash flow sensitivity to market cash flow news, what literature usually calls cash flow risk, is monotonically increasing in leverage and its difference between the two extreme portfolios is statistically significant. However, these betas are low and not so economically different of each other. This sensitivity has been argued to capture permanent effects on cash flows. On the other hand, what is striking is the magnitude and high difference between the cash flow sensitivity to market discount rate news. In fact, this beta for low leverage firms is 0.24 and for high leverage firms is -0.15.

[4] The persistence of the VAR explanatory variables may cause bias in the estimates of predictive regressions. Moreover, the statistical significance of the one period return prediction equation does not guarantee that the news terms are not materially affected by the small-sample bias and sampling uncertainty, since the news terms are computed using a nonlinear transformation of the VAR parameter estimates. Campbell et al. (2009) address these issues in their paper, running several robustness checks, and confirming the validity of the news terms extracted through the use of VAR parameters in tables 4.3 and 4.6. In the present work, the alternative implementations further confirm the validity of the results.

Table 4.7: Four Beta Decomposition

This table reports the firm-level news components of the discount-rate and cash flow betas measured for book leverage-sorted portfolios in Table II, panel A . They are $\beta_{CFi,CFM} = \frac{Cov(N_{i,CF_{t+1}}, N_{M,CF_{t+1}})}{Var(r_{M,t+1})}$, $\beta_{CFi,DRM} = \frac{Cov(N_{i,CF_{t+1}}, -N_{M,DR_{t+1}})}{Var(r_{M,t+1})}$, $\beta_{DRi,CFM} = \frac{Cov(-N_{i,DR_{t+1}}, N_{M,CF_{t+1}})}{Var(r_{M,t+1})}$, $\beta_{DRi,DRM} = \frac{Cov(-N_{i,DR_{t+1}}, -N_{M,DR_{t+1}})}{Var(r_{M,t+1})}$. To construct portfolio news terms, firm-level $N_{i,DR}$ and $N_{i,CF}$ are first extracted from the market-adjusted firm-level panel VAR, then the corresponding market-wide news terms are added back, and finally the resulting firm-level news terms are value-weighted, as suggested by Campbell et al. (2009). The portfolio i=L is the extreme low leverage portfolio and i=H is the extreme high leverage portfolio. H-L represents the difference between extreme high and low leverage portfolios. Standard errors are in parentheses, estimated using the Newey-West Method with five lags.

	L	2	3	4	H	H-L
$\beta_{DRi,DRM}$	1.07	1.11	1.11	1.12	1.10	0.03
	(0.09)	(0.11)	(0.11)	(0.11)	(0.12)	(0.03)
$\beta_{CFi,DRM}$	0.24	0.08	-0.10	-0.14	-0.15	-0.39
	(0.10)	(0.06)	(0.05)	(0.04)	(0.05)	(0.06)
$\beta_{DRi,CFM}$	-0.048	-0.038	-0.046	-0.045	-0.049	0.00
	(0.06)	(0.07)	(0.07)	(0.06)	(0.07)	(0.02)
$\beta_{CFi,CFM}$	0.10	0.12	0.14	0.14	0.16	0.06
	(0.05)	(0.05)	(0.05)	(0.06)	(0.07)	(0.03)

Since it is considered that firms manage their capital structures to maximize shareholder wealth, it is possible that these sensitivities are related to the determinants of leverage. That is, the results suggest that firms react to these risks to set their capital structure. For example, a manager could consider financial flexibility as an important factor influencing his decisions, and the degree of the impact of a short-run shock in the firm's cash flow can be fundamental to determine the correct level of leverage in the balance sheet. In Chapter 5, I take a first step to understand this claim by analyzing potential determinants of these betas.

As shown in tables 4.8 and 4.9, both alternative implementations give the same pattern in betas as obtained through the VAR approach. More important, the long-run risk implementation, which is based on the cash-flow predictability, provides the same patterns in cash-flow betas. The magnitudes are somewhat different, basically due to both the choice of measures to proxy for cash flow and discount rate news and the different horizons used. However, these findings confirm the effect of short and long run shocks on firms'cash flow innovations, and reinforce the positive (negative) relation between firms'cash flow innovations and market cash flow (discount rate) news, for portfolios sorted based on book leverage.

Table 4.8: Long Run Risk Implementation

This table reports the firm-level news components of the discount-rate and cash flow betas measured for book leverage-sorted portfolios. The sensitivities of portfolios' cash flow innovation to market cash flow news is given by the slope of the following regression:

$$\sum_{j=1}^{N} \rho^j g_{i,t+j,j+1} = \alpha + \beta_{CFi,CFM} \sum_{j=1}^{N} \rho^j g_{M,t+j,j+1} + \epsilon$$

The portfolio i=L is the extreme low leverage portfolio and i=H is the extreme high leverage portfolio. H-L represents the difference between extreme high and low leverage portfolios. Standard errors (in parentheses) are estimated using the Newey-West Method with five lags.

	$\beta_{CFi,CFM}$					
	L	2	3	4	H	H-L
$N = 2$	0.14	0.36	0.33	0.45	0.39	0.25
	(0.045)	(0.085)	(0.088)	(0.110)	(0.057)	(0.126)
$N = 3$	0.21	0.25	0.36	0.21	0.41	0.20
	(0.070)	(0.076)	(0.080)	(0.060)	(0.075)	(0.037)
$N = 4$	0.31	0.42	0.55	0.79	0.97	0.66
	(0.089)	(0.113)	(0.119)	(0.271)	(0.171)	(0.118)
$N = 5$	0.76	0.99	1.21	1.12	1.23	0.47
	(0.085)	(0.088)	(0.167)	(0.163)	(0.130)	(0.108)

Table 4.9: Direct Proxies Implementation

This table reports the firm-level news components of the discount-rate and cash flow betas measured for book leverage-sorted portfolios. Portfolio level cash-flow news are the following:

$$N_{i,CF,t+1} = \sum_{j=1}^{N} \rho^{j-1} roe_{i,t,t+j}$$

where $roe_{i,t,t+j}$ is the log of real profitability for portfolio i, sorted in year t, and measured in year t+j. Discount-rate news at the market level are:

$$-N_{M,DR,t+1} = \sum_{j=1}^{N} [\rho^{j-1} \Delta_{t+j} ln(P/E)_M]$$

The portfolio i=L is the extreme low leverage portfolio and i=H is the extreme high leverage portfolio. H-L represents the difference between extreme high and low leverage portfolios. Standard errors (in parentheses) are estimated using the Newey-West Method with five lags.

	$\beta_{CFi,CFM}$					
	L	2	3	4	H	H-L
$N = 2$	0.03	0.04	0.04	0.05	0.06	0.03
	(0.028)	(0.019)	(0.015)	(0.019)	(0.016)	(0.017)
$N = 3$	0.13	0.25	0.26	0.37	0.39	0.23
	(0.141)	(0.093)	(0.080)	(0.092)	(0.102)	(0.071)
$N = 4$	0.21	0.45	0.65	0.74	0.77	0.56
	(0.061)	(0.120)	(0.083)	(0.137)	(0.145)	(0.114)
$N = 5$	0.60	0.93	1.16	1.17	1.20	0.60
	(0.100)	(0.213)	(0.438)	(0.397)	(0.269)	(0.358)

	$\beta_{CFi,DRM}$					
	L	2	3	4	H	H-L
$N = 2$	0.09	0.02	-0.01	-0.04	-0.06	-0.13
	(0.150)	(0.200)	(0.109)	(0.032)	(0.051)	(0.013)
$N = 3$	0.12	0.08	-0.03	-0.10	-0.15	-0.27
	(0.113)	(0.082)	(0.599)	(0.093)	(0.075)	(0.130)
$N = 4$	0.22	0.10	-0.04	-0.14	-0.20	-0.42
	(0.101)	(0.060)	(0.710)	(0.084)	(0.099)	(0.153)
$N = 5$	0.30	0.11	-0.05	-0.19	-0.23	-0.53
	(0.102)	(0.051)	(0.227)	(0.316)	(0.111)	(0.172)

Chapter 5

Determinants of Risk Exposures and Capital Structure

We noted there is a relevant heterogeneity in betas between firms' capital structures, which seems to be related to temporary and permanent systematic shocks affecting firms' cash flows. Moreover, the importance of these shocks is different for firms with different book leverages. The next step is to investigate what determines these betas. Since financial leverage seems to be an output of an optimal decision, it is natural to associate these betas with variables used to explain the cross sectional heterogeneity of firms' capital structures.

In a related study, Gorbenko and Strebulaev (2009) also argue that temporary and permanent idiosyncratic shocks to firms' cash-flows have different impacts on corporate financial policies. They build a theoretical model with potential predictions in line with the empirical observations about financial conservatism and low leverage phenomena.

Frank and Goyal (2007b) examine an extensive list of factors which could conceivably explain why heterogeneity exists between firms' capital structures. They conclude that only profitability, firm size, market-to-book, median industry leverage, tangibility and expected inflation can reliably be related to leverage. That is, their coefficients are statistically significant in a predictive regression, where the dependent variable is leverage. However, they together only explain about 25% of the total variation. What is interesting is that accounting measures of risk, market conditions and macroeconomic variables are not significant.

Indeed, what is generally considered in capital structure theory is the volatility (idiosyncratic) risk of cash flows. Trade-off theory argues that firms with more volatile cash flows face higher expected costs of financial distress and should use less debt. More volatile cash flows reduce the probability that tax shields will be fully utilized. Thus higher risk should result in less debt. Pecking order theory predicts that firms with volatile stocks suffer more from adverse selection. Hence "riskier" firms have higher leverage.

Here, I depart from this view and analyze how systematic risk is associated with capital structure decisions by investigating the relation between variables successfully used as leverage predictors and cash-flow betas.

I use a parsimonious list of factors considered to have some influence on corporate leverage, analyzing some of the variables proposed by Frank and Goyal (2007b) and including capital expenditures as an alternative proxy for growth, and probability of default to be extensively used as a direct proxy related to financial distress risk. Then, the final set of variables is composed of profitability (ROA), unlevered z-score, tangibility, capital expenditures (capex), firm size, and book-to-market.

Although this choice relies fundamentally on the implications of the main theories of capital structure decisions, I do not specifically test a particular theory. Instead of predicting leverage directly, I investigate whether book leverage is associated with two sources of cash-flow risks, and use cross-sectional firm-level regressions to identify whether the above variables predict their different betas. While distinct predictions given by extant theories seem uncontroversial, there is significant disagreement in some cases. For example, trade-off theory predicts that profitable firms use more debt given their lower expected costs of financial distress. In a dynamic tradeoff model, leverage appears to be negatively related to profitability. For the pecking order theory more profitable firms will become less leveraged over time.

Therefore, I consider the effects both on the entire sample and on the two extreme low and high leverage portfolios to capture any asymmetric effect of these variables on risk sensitivities. This investigation has two purposes. First, it allows studying the effect of well documented leverage predictors on betas. Second, it helps in inferring the existence of any unobserved factor related to leverage not captured by the existing predictors.

Although the subject of this study is not to make an extensive analysis of the determinants of leverage, the fact that leverage is clearly associated with betas seems to be informative about capital structure decisions. If the variables expected to explain it are not completely related to these betas, and betas have a clear relation to financial leverage, we can argue that there is something missing. In fact, Lemmon, Roberts, and Zender (2008) acknowledge the importance of an unobserved factor (firm fixed effect) which explains much of the heterogeneity in leverage.

I check how these factors responds to market shocks. Specifically, I estimate the following equations[1]:

$$(N_{i,CF,t}) \times (N_{CFM,t}) = X_{i,t-1}B + u_{i,t} \tag{5.1}$$

$$(N_{i,CF,t}) \times (-N_{DRM,t}) = X_{i,t-1}B + u_{i,t} \tag{5.2}$$

[1] Campbell et al. (2009) explore a similar regression and relate the characteristics of each stock linked to its risk to explain cash-flow and discount rate betas

Equations (5.1) and (5.2) link the components of firms' risks to predictors of each firm's leverage. The estimation technique is as follows. First, I cross-sectionally demean both firms' cash flow innovations and independent variables. Next, I normalize the independent variables to have an unit variance. After estimating the regressions, I divide the coefficients by market variance. The results presented in Table 5.1 represent the effect on betas of a one-standard deviation change in the independent variable.

The first two columns in table 5.1 show that all variables, but book-to-market, predict cash-flow cash-flow beta, and all variables, but capital expenditures and log assets, predict cash-flow discount-rate beta. That is, variations in book-to-market are solely associated with short-term sensitivities of cash flows and variations in capital expenditures and firms' assets are solely associated with long-term sensitivities of cash flows.

Some aspects stand out in this table. Positive changes in firm's profitability decreases its cash flow sensitivity to market cash flow news (permanent), but increases significantly its sensitivity to market discount rate news (transitory). As cash flows becomes larger, the importance of temporary shocks will be much higher, even though permanent shocks have either little or zero effect on cash flows.

Specifically, as firms become more profitable, permanent shocks to their cash flows are attenuated. Actually, the sensitivity of cash flow innovations to market cash flow news is low, but negative. It seems to indicate that more profits signal good future prospects, and that these firms become more diversified. A similar interpretation could be applied when we look at firm size (log assets). For both extreme portfolios, larger firms are less sensitive to permanent shocks only.

On the other hand, increases in profits are associated with higher discount rate

Table 5.1: Determinants of Betas and Capital Structure

This table reports results of a panel regression of firms' cash flow sensitivities to market news:

$$(N_{i,CF,t}) \times (N_{CFM,t}) = X_{i,t-1}B + u_{i,t} \quad (5.3)$$
$$(N_{i,CF,t}) \times (-N_{DRM,t}) = X_{i,t-1}B + u_{i,t} \quad (5.4)$$

where $X_{i,t+1}$ is a variable vector of firms' characteristics (ROA, Unlevered Z-score, Tangibility, Capex, Log(total assets), and Book-to-market). All variables are defined in Appendix. Sample period: 1965-2006. Standard errors (in parentheses) take into account clustering in each cross-section. * represents 5% of statistical significance, ** represents 1% of statistical significance.

	All firms		L		H	
	β_{CF_i,CF_M}	β_{CF_i,DR_M}	β_{CF_i,CF_M}	β_{CF_i,DR_M}	β_{CF_i,CF_M}	β_{CF_i,DR_M}
ROA	-0.03**	0.18**	-0.01	0.22**	-0.06**	0.14**
	(0.011)	(0.020)	(0.018)	(0.001)	(0.045)	(0.0370)
Unlevered Z-score	0.02**	-0.07**	0.04	-0.16**	0.00	0.03
	(0.008)	(0.018)	(0.021)	(0.035)	(0.018)	(0.028)
Tangibility	0.05**	-0.14**	0.12**	-0.21**	0.03**	-0.10**
	(0.005)	(0.013)	(0.016)	(0.036)	(0.006)	(0.017)
Capex	-0.013**	0.015	-0.045**	-0.005	-0.005	0.007
	(0.005)	(0.014)	(0.016)	(0.038)	(0.005)	(0.016)
Log(Total Assets)	-0.02**	-0.02	-0.03**	0.01	-0.02**	-0.02*
	(0.003)	(0.011)	(0.009)	(0.019)	(0.004)	(0.010)
Book-to-Market	-0.005	-0.017**	-0.013	-0.037**	-0.007	-0.023*
	(0.003)	(0.003)	(0.028)	(0.013)	(0.005)	(0.011)
$adj.R^2$	0.8%	1.0%	1.2%	2.1%	0.81%	0.79%

risk (or temporary risks). An increase in profitability makes the cash flows riskier in response to temporary, sometimes high, shocks to the market discount rate. That is, there seems to be another channel affecting the cash flow of firms associated with an increase in profitability and captured by short-run market shocks. This effect is pervasive to both extreme portfolios, but more pronounced for low leverage firms.

An increase in tangibility increases the cash flow sensitivity to market cash flow innovations, but decreases the cash flow sensitivity to market discount rate innovations. As firms' assets become more tangible, permanent shocks seem to affect their cash flows more because it is natural to think that high debt payments make firms more exposed to systematic risks if they have more tangible capital (disinvestment costs should be higher). Therefore, permanent shocks might impact these firms more.

A striking result is obtained when we look at the probability of default. It is shown in the table that only low leverage firms are affected by this measure. Moreover, as default becomes more likely, the cash-flow sensitivities to market discount-rate increases significantly.

As we noted before, book-to-market only determines the cash-flow discount-rate beta. A positive variation in growth opportunities increase the cash-flow sensitivity. However, low leverage firms have a higher increment in risk. Some papers argue that growth firms suffer more both from the underinvestment problem and from the asset substitution. Also, a low book-to-market indicates that firms' cash flows have higher duration of cash flows and, hence, their cash flows sensitivities suffer more from the effects of market discount rate news.

Putting these results together, we can draw a clear picture of what these sensitivities are potentially capturing. It has been argued in many papers that a decrease in financial distress risk is associated both to lower probability of default and to more tangible assets. Moreover, underinvestment problem and asset substitution are more evident when firms go toward distress. From above, it seems that cash-flow discount-rate beta is capturing exactly this risk. In fact, probability of default matters only for low leverage firms, the effect of tangibility on risk is twice as higher than for high leverage firms, and the effects of book-to-market changes only affect low leverage firms.

Also, the findings above suggest that discount-rate shocks have relatively more importance for low leverage firms. They seem both to capture financial distress risk (implied from the effects of variation in tangibility, in unlevered z-score and in book-to-market) and negative temporary impact on cash flow innovations [2]

Table 5.2 shows the results of the regressions (5.3) and (5.4), but using news calculated from the alternative implementations. It can be seen that the results are materially unaffected.

[2] These results suggest that firms' financial decisions are in response to these risks. That is, (low leverage) firms choose their capital structure in response to the (higher) systematic risks they face, represented by the risks described above. It is an interesting topic for future research.

Table 5.2: Determinants of Betas and Capital Structure - Alternative Implementation
This table reports results of a panel regression of firms' cash flow sensitivities to market news:

$$(N_{i,CF,t}) \times (N_{CFM,t}) = X_{i,t-1}B + u_{i,t} \tag{5.5}$$
$$(N_{i,CF,t}) \times (-N_{DRM,t}) = X_{i,t-1}B + u_{i,t} \tag{5.6}$$

where $X_{i,t+1}$ is a variable vector of firms' characteristics (ROA, Unlevered Z-score, Tangibility, Capex, Log(total assets), and Book-to-market). Cash Flow and Discount Rate news are extracted through alternative implementations. Variables are defined in Appendix. Sample period: 1965-2006. Standard errors (in parentheses) take into account clustering in each cross-section. * represents 5% of statistical significance, ** represents 1% of statistical significance.

	Long Run Risks	Direct Methods	
	β_{CF_i,CF_M}	β_{CF_i,CF_M}	β_{CF_i,DR_M}
ROA	-0.01**	-0.00	0.41**
	(0.004)	(0.009)	(0.005)
Unlevered Z-score	0.05**	0.002	-0.10**
	(0.004)	(0.003)	(0.006)
Tangibility	0.15**	0.25**	-0.09**
	(0.01)	(0.05)	(-0.02)
Capex	-0.10**	-0.10**	-0.00
	(0.032)	(0.028)	(0.00)
Log(Total Assets)	-0.12*	-0.26**	0.05
	(0.057)	(0.061)	(0.03)
Book-to-Market	-0.010	-0.05*	-0.07**
	(0.008)	(0.061)	(0.022)
$adj.R^2$	1.0%	0.92%	3.93%

Chapter 6

Concluding Remarks

In this dissertation, I investigated potential explanations for the relation between financial leverage and expected equity returns. Empirical evidence contradicts the theoretical prediction that leverage should be positively related to equity return.

First, I calculated cash-flow and discount-rate betas for portfolios sorted based on book leverage and showed that low leverage firms have lower cash-flow risk and higher discount rate risk than firms with high leverage. Thus, the amplification effect of leverage on equity risk, which comes naturally from the textbook intuition, seems to be dominated by greater exposure to different sources of systematic risks, generating an essentially flat relation between leverage and expected equity returns.

Next, I argued that the last result is a natural outcome of the association between the firms' cash-flow properties and the two distinct sources of systematic risks described above. Since firms' cash flow prospects are fundamentally important for capital structure decisions, cash flows might be affected by different shocks that are significant enough to be relevant for capital structure decisions. By further decomposing each firm's return into its two innovations, I found that the high (low) betas of low leverage stocks with the market discount rate (cash-flow) shocks are determined by the properties of the firm's cash flows.

The heterogeneity in betas among firms' capital structures seems to be related to temporary and permanent systematic shocks affecting firms' cash flows. Moreover, the importance of these shocks is different for firms with different book leverages. Then, in the last section, I studied the determinants of risk exposures and their links to capital structure decisions.

Instead of predicting leverage directly, I investigated whether book leverage is associated with two sources of cash-flow risk and used cross-sectional firm-level regressions to identify whether these characteristics predict their different betas. I considered the effects of profitability (ROA), unlevered z-score, tangibility, capital expenditures (capex), firm size, and book-to-market on the risk sensitivities for the entire sample and for the two extreme low and high leverage portfolios.

I showed that all variables, but book-to-market, predict cash-flow cash-flow beta, and all variables, but capital expenditures and log assets, predict cash-flow discount-rate beta. That is, variations in book-to-market are solely associated with short-term sensitivities of cash flows and variations in capital expenditures and firms' assets are solely associated with long-term sensitivities of cash flows.

Moreover, cash-flow discount-rate beta is potentially capturing financial distress risk, which is more pronounced for low leverage firms. In fact, probability of default matters only for low leverage firms, the effect of tangibility on risk is twice as higher than for high leverage firms, and the effects of book-to-market changes only affect low leverage firms. Also, these findings suggest that discount-rate shocks have relatively more importance for low leverage firms.

There are important topics for future research. It will be interesting to analyze theoretically and empirically what are the mechanisms relating cash flow risk and discount rate risk to stylized empirical facts in capital structure literature, such as debt conservatism, capital structure dynamics, and cross section determinants of capital structure.

Appendix Variable Definition

This Appendix details the variable construction for analysis of the CRSP and COMPUSTAT sample. All words in parentheses refer to the annual Compustat item.

Excess log return on the market = log excess return on the CRSP value-weighted index over Treasury bills;

Yield spread between long-term and short-term bonds = difference between the ten-year constant maturity taxable bond yield and the yield on short-term taxable notes, in annualized percentage points (taken from Global Financial Data);

Market's smoothed price-earnings ratio = log ratio of the S&P 500 price index to a ten-year moving average of S&P 500 earnings;

Small-stock value spread = difference between the log book-to-market ratios of small value and small growth stocks;

Book Leverage = (Long-Term Debt - Total (DLTT) + Debt in Current Liabilities (DLC)) / Total Assets (AT).

Market Capitalization = $PRCC_F \times CSHO$;

Market Leverage = $(DLTT + DLC)/(PRCC_F \times CSHO + DLC + DLTT)$.

Firm Size = Log(Sales).

Collateral = Net PPE (PPENT) + INVT / AT

Tangibility = Net PPE (PPENT) / AT.

Profitability = EBITDA (OIBDP) / AT.

Book Value of Preferred Stock (BVPS)= Preferred Stock - Redemption Value (PSTKRV); If PSTKRV is missing, I substitute (in that order) by Preferred Stock - Liquidation Value (PSTKL) or Preferred/Preference Stock (Capital) - Total (PSTK).

Stockholders' Equity = Stockholders' Equity (SEQ); If SEQ is missing, I assume equal to Common/Ordinary Equity - Total (CEQ) + BVPS or equal to AT - LT;

Book Common Equity (BE) = STEQ + TXDB + ITCB - BVPS;

Book-to-Market Ratio = BE / ME;

Unlevered Z-score = 3.3*Pre-tax income(PI) + Sale + 1.4*Retained earnings (RE) + 1.2*(Current assets (ACT)- Current liabilities (LCT))/AT

ROE = Net Income (NI)/ Book Value of Assets (AT);

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